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VISIT TO DUTCH STATE MINES AND OTHER RESEARCH CENTRES SEPTEMBER, 1957

by

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VISIT TO DUTCH STATE MINES

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Arrived September 23rd at Heerlen, Holland. Saw Director, Van Os and Dr. Krijgsman. Visit to Central Research Station at Emma Washery (Dr. Meerman, Mr. Leeman) Baum Jigs, HM magnetite cyclones, DSM H-M Baths, centrifuges, filters, rotary driers, sieve bend screens, flottation. Visit to Central Laboratorium at Geleen and Maurits washery (Dr. Berkhoff, Mr. Bakels, Mr. Kardoun) Dr. Levallier).

MOST INTERESTING DEVELOPMENTS AT DUTCH STATE MINES

1. Sieve Bend Screens

They have been described in the technical literature. Very extensively used in all sizes at D.S.M. for dewatering, sizing, desliming. They seem very economical, efficient and should be a very worthwhile subject of investigation for use on Canadian coals at the F.R.L. either in Ottawa or in Edmonton.

2. Automatic Continuous X-ray Determination of Ash Content

This is a new process shown to me very confidentially - which will be first reported at the International Conference on Coal Preparation next summer at Liege, Belgium. I saw a lab installation at Burma and an industrial installation at Maurits mine. Entirely automatic by classic continuous sampling, coal increments are taken from any coal flow, crushed, dried, split, ground riffled, and submitted to x-ray reflections with comparisons to standard samples. The results in ash contents are automatically registered on charts. It is an outstanding achievement to the credit of D.S.M. and can be used for

the instantaneous control of a coal washery as a whole or of a blending unit or of a coal cleaning apparatus. The x-ray unit seems to be quite suitable for use in a dirty and dusty area such as coal washeries. Although this process of ash determination should be of great interest for Canadian coal mines, and will soon be available, it seems to me that it could be preferable for F.R.L. to study processes of ash determination using radio isotopes as sources rather than x-ray units because of the greatly lowered costs. From discussions with Cerchar engineers, they also seem to be in favour of radio isotopes rather than x-rays and have several projects along these lines although they try to avoid continuous sampling by using direct analysis. It seems to me that the delay caused by sampling (about 2 minutes) is not prohibitive for the control of a cleaning unit and should lead to much more accurate results than direct radiations.

3. Binderless Briquetting at High Temperatures

This is a very interesting project, which Mr. Kardoun showed me on pilot plant scale at Maurits washery. A lot of work has already been done and the results are very encouraging. The purpose was to manufacture a smokeless fuel as cheaply as possible, and the process is based, as far as I can see, on the Hardy studies of briquetting, but it has the great advantage that it can be used with an ordinary roll press and does not require a ring roll press. I saw a mixture made of 70% anthracite plus 30% of bituminous (15 to 30% MV) coal plasticized at 400°C. The mix is made and conveyed pneumatically by hot gases and degassed by cyclones. Star valves at all inlets and outlets. Pressing of briquets at about 600 atmospheres instead of 300 atm. for ordinary briquets. This is easy to obtain with larger rolls (1.40 meter), heavy feeding, and special springs. More cooling of the briquets is needed.

The briquets obtained compare favourably in quality with regular briquets of the same composition plus binder, but are smokeless and should be a little cheaper on large scale production. Main difficulty: control of the temperatures, which is obtained by control of feeding. On the whole the process is very promising and could be of great value for the Canadian mines as it requires very minor modifications of equipment and could greatly improve their operations.

4. At the Central Research Station, the D.S.M. have already installed two electronic computers (one imported from the U.S.A. and a new one from France). These large calculating machines have already rendered great services both in operations and research, although the D.S.M. is a relatively small organization (only about 8 million tons of coal per year).

Re: Dr. J. Visman's Enquiries Concerning the Edmonton F.R.L. Pilot Plant

I have discussed them at length with Dr. Krijgsman and his collegues and the results can be very briefly summarized as follows: There is no objection to the use of 8 inch cyclones rather than the 14" advocated by Dr. Krijgsman, but it should be noted that the 8" cyclones are likely to give better results than the 14" and consequently, the conclusions should not be directly transposed from one size to the other. No objections either to Pneuma pumps. Rubber valves at the apex are not suitable for control simply because controls by the vortex finder length is better, due to its wider range of action.

Re: Patents licensed by D.S.M. to Dorr-Oliver, Heyl Xlatterson, etc. Dr. Krijgsman told me he had immediately answered Dr. Visman on this point by direct correspondence.

Re: Developments on Dry Coal Cleaning

They appear to be top secret and as I could never be alone with Mr. Bakels, he could never give me any information. Following Dr. Visman's advice, I did not ask anyone else.

Generally speaking, D.S.M. prefer 2-way separators rather than 3-way separators, which have not proved very satisfactory in any shape of cyclones. Rewashing in another 2-way cyclone is to be preferred. Gravity feeding is always favoured over pump feeding.

VISITS IN GERMANY

Visits in the Area of Essen

Visit to Stein Kohlen Berg Bau Verein, Essen (Dr. Egerink, Dr. Lemke, Dr. Mayer, Dr. Finze, Dr. Dahme. Visit to the Petrography Laboratory of Professor Dr. Mackowsky and Dr. Friemehlt.

This is a large laboratory where extensive microscope work is carried on by many graduate students working on thesis on micro studies of coals and coal briquets. All examinations of briquets are in reflected light and the preparation of the specimens is very similar to that used by Dr. Alpern at Cerchar. This very interesting work is frequently reported in the literature and especially in recent years in the Proceedings of the International Conferences on Coal Petrology (e.g. Liege, May 1955, Paris, October 1957).

Visit to the Ickern Washery, near Essen: (Mr. Johnson).

This is one of the most automatically controlled plants in the world. Built by Humboldt. Heavy Media baths for the coarse coal, Baum jigs for the fine coal. Heavy medium pyrites plus shales from the mine itself (extracted from the refuse). Only one operator for the whole plant. Very impressive showplace of automation.

Visit to Klockner - Humboldt - Deutz A.G., at Koln.

Very interesting visit to the research division of one of the largest manufacturers of coal preparation and briquetting equipment. (Dr. Vogano, Mr. Junker, Dr. Werner, Mr. Isenhart, Mr. Wolf, Mr. Lachmitt).

Practically all kinds of equipment for coal cleaning, briquetting and ore dressing, also for lignites. Most interesting developments at Humboldt. (1) Humboldt sink-float separator without any moving parts within the pulp (only compressed air at 2-6 atm.); regeneration of the diluted medium is obtained in an inclined baffle type clarifier (high output and efficiency with small space requirements). Great efforts are made by Humboldt to sell heavy media washeries for fine coal 0-10 mm. (minus 3/8 inch) by claiming higher yields, lower overall net costs. (2) Studies to improve the operation and the extraction of the refuse in Baum jigs with zero types of rotary slide valves and counter movements in the extraction chambers to obtain flow cycles as regular as possible. (3) Submerged counter vibrating screen with mass balance for screening of slurries. (4) "Duo" screens where plugging of fine wet material is prevented by the relative motion of 2 networks of wires, one fixed, the other moving, thereby resulting in apertures of changing dimensions and shape while the screen is in operation. (5) Vibratory centrifugal dewaterers, where the oscillations superimposed to the rotation of the drum replace mechanical discharge devices with an improvement in the dewatering and a decrease of the rate of screen wear and of the power demand. (6) Vacuum filteration by non-cellular rotary filters, giving high vacuum with a relatively small pump, higher output with better drying at lower capital and operating costs.

(7) Pilot plant for low shaft metallurgical furnace for briquets made of iron ore and coal (of various rank, even lignites). Very promising. Capacity of the pilot plant unit; 16 to 20 tons (it will be a long and low unit instead of the classical round pilot plant. The briquets are made with 3 to 5% of binder (pitch).

Visit to the Katharina Plant of the Essener Steinkohle, Essen

(Dr. Wulf, Dr. Friemehlt, Mr. Bartelt, Mr. Beckhaus, Mr. Tengalmann, Mr. Wagner, Mr. Meyer).

This is one of the newest, largest and most impressive briquetting plants in Europe. The design is classical but the binder content has been reduced from 7% to 3.7%. Without excessive detriment to the mechanical quality of the briquets by a number of improvements, which may be summarized as follows: all factors of briquetting are made as regular as possible, crushed coal pitch introduced very evenly in coal which is at rather high temperature, 50 ton/hour presses with large diameter rolls (1.4 meter), very dry mix. Raw coal (semi anthracite) is 0-10 mm., from which the 0-1.5 mm. is not washed and the 1.5-10 mm. is cleaned in Baum jigs and dewatered. Then all coals are very carefully blended to obtain a briquetting coal with about 8% of minus 60 u and 8% of coal 60 u - 1 mm. The coal is dried in horizontal driers of 50 ton/hour capacity (temperature 110-120-C). Coal dust is recovered (80% is minus 0.1 mm.) in cyclones and electrostatic filters and shipped to power plants.

Coal pitch (of Kraemer Sarnow softening point 70-73°C) is crushed in roll crushers to minus 3 mm. (with 8% of 0.1 - 1 mm. and 10% of minus 0.1 mm.).

Coal and coal pitch are weighed on Schenk automatic scales (guaranteed at ± 1%) which automatically regulate the proportions of the two components of the mix (the installation is similar to the new Cerchar plant in Maurchin). Double screw mixers - the Fluxers are always full (the overflow is returned to the circuit), they are heated with steam at 150°C. (consumption of steam is only 12 kg/ton). Fluxing time: 7 minutes. The mix from the fluxer is very dry about 1% moisture. Increasing the moisture content by additions of hot water has been tried but it did not improve the quality of the briquets. Water is sprayed on the rear roll.

The 50 ton/hour Schustermann presses have double rolls of 1.4 m. of diameter each with 13 rows of 120 pockets on a width of 550 mm. Roll speed: 0.8 m/sec. Duration of compression: 0.04 sec. Speed: 11 R.P.M. The distributor blades are of the rotating type different from the sliding type used on Komarek Greaves presses.

Samples of 10 briquets are taken every 15 minutes and tested after 1-1/2 hour of cooling on a compressed air testing press. The briquets are ovoids of 22 grams (there is a general trend in Europe to make small briquets of about 20 grams instead of the 50 to 90 grams classic ovoids because the smaller briquets have better combustion qualities. After pressing, the briquets are cooled on wire mesh and perforated upon conveyors and belt conveyors during approximately 7 minutes.

Visit to the Rosen Blu Mendelle Mine, Mulheim
(Mr. Heddenhausen)

This is one of the largest briquetting plants in Europe. 8 Koppern presses of 25 ton/hour (classic design - rolls of 1 meter diameter with central

gear drive from reductors). No belt drives, only reductors. 22 gram briquets. The anthracite coal is not dried (about 3% moisture). Size: minus 0.5 mm. 7 to 8% coal tar pitch - Fluxer calorifugated and maintained at 100°C. with steam at 150°C. Press at 80°C. The fluxer has stationary arms which is not the case at the Katharina plant and many other new plants. Instead of belt scales, the proper proportions of the mix are obtained by rotating metering plate feeders. Very elaborate dust collecting system in basement, keeping the whole plant under reduced pressure and thus remarkably clean. This fine plant makes a quality product with very fine coal but the binder consumption is just about average by European standards.

Visit to Koppern, Hattingen (Mr. Horschmann, Mr. Schafer).

This is one of the largest manufacturers of briquetting equipment. All kinds of designs of briquetting plants. Ram presses of the horizontal or vertical table types. Various roll presses in all sizes. Main developments at Koppern are: improved accessibility of all parts, control of dust and steam (before it is condensed and thereby objectionable), streamlined driers by reducing gears, briquet loading by storage rooms of the expandable telescopic type, controlled blending and proportioning of the mix. Koppern has not yet adopted the construction of press rolls in sections (for easier installation and repairs) such as the Schustermann Kramer Baum presses.

Visit to the Bergbau Museum, Bochum.

Outstanding display of equipment of mines, washeries, briquetting plants, etc. Model mine, model units, all kinds of exhibits of great interest.

Visit to the Deutscher Braun Kohlen-Industrie Verein, Koln (Mr. Gindely).

Association of lignite producers (Dr. Gold).

Visit to Braunkohlen Und Brikettwerke Roddererube A.G. Vereinigten Ville Plant at Knapsack, (Dr. Kasting, Mr. Kunstle, Mr. Rolland).

This is a large and very modern brown coal briquetting plant of the classic extrusion press design. The lignite is dried to 14% moisture in classic tubular driers (80°C.) then cooled to 40°C. This brown coal 0-5 mm. is pressed under (estimated) 1000 kg/cm^2 in classic two knuckle toggle joint type presses.

In this plant is also found the only ring roll press in operation in the Rhein area; it is a Lurgi - Humboldt press based on the Apfelbeck design where lignite minus 1 mm. dried at 8 - 10% moisture is pressed without binder under (estimated 1700 kg/cm^2. Apparently, this ring roll press can handle the minus 4 mm. and give up to 2000 kg/cm^2. This press makes 360 ton/day (the capacity of this type of press is from 250 to 500 ton/day) depending on the qualities of the brown coal which compares with the low outputs of extrusion presses (single line = 60-90 ton/day). However extrusion presses with 2 or even 3 lines seem to be very satisfactory.

The ring roll press seems to be preferable for making strongly densified briquets for low temperature carbonization, e.g. for the Lurgi-Krupp lump coke process (a unit of this type is installed at this plant).

Visit to the Fortuna Open-Cast Brown Coal Mine.

In this mine are operated the 3 largest excavators in the world. They are of the wheel type, based on the power shovel principle but avoiding

its defect: viz the discontinuous operation. This paddle or bucket wheel excavators can dig in layers and permit the selective mining of special strat, e.g. partings - mounted on big crawlers - telescoping loading unit also on crawlers - excavation either above or below the crawler level (up to 50 m. above the 20 m. below). Total weight: 5,500 tons. Output: more than 150,000 cubic meters/day of solid material even hard clay or lignite.

Visit to the Laboratory of the Rheinisch-Westfalischen Technischen Hochschule, AAchen (Dr. Petersen)

The Inichar research centre has built a new coal preparation research laboratory at Liege. All the installations are to be completed for the next International Conference on Coal Preparation in Liege next summer. They plan considerable developments in their activities on coal cleaning and briquetting e.g. a cyclone pilot plant similar to that planned for the Edmonton laboratory.

Conclusion

This trip has been extremely interesting and has permitted me to make valuable contacts, and gather a great deal of information and documentation on coal cleaning and briquetting research and practice with the purpose of applying it for the benefit of the Canadian Coal Industry.

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R.R. Charbonnier
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